owner switch designated in the LERG. No specific implementation is implied by this term.

Non-involved Switch	A switch that does not have any number ported to/from it.
Non-LNP Capable Switch	A switch that does not have the capabilities described in this Generic Requirements document. The switch may still have numbers ported to or from it. In addition, the switch can use existing routing techniques for routing calls to the appropriate lines or trunks.
Non-Ported Number	A DN that may or may not be in a Portable NPA-NXX, but which has not been moved between switches
Number Portability Information	Information associated with a ported DN used by AMA recording to identify the recipient switch (via LRN) of the ported DN to assist in billing. Eventually, this information set will be expanded to include Service Provider Identity and location of the ported DN as well as LRN.
Operational User	The service provider's craft personnel.
Originating Switch	The switch where the call originates.
Portable NPA-NXX	An NPA-NXX in which one or more DNs may have been ported.
Ported Number	A DN that has been moved from one switch to another where the switch may or may not be the same service provider.
Rate Center	The division of a switch into zones for billing purposes.
Recipient Switch	The switch the DN is ported to as defined by the LRN for the ported subscriber.
Service Portability	Allows an end-user to retain his/her DN after changing services, e.g. POTs to ISDN.
Service Provider Portability	Allows an end-user to retain his/her DN after changing service providers.
Signal Ported Number Trunk Group Option	Allows a trunk group to be provisioned to send the dialed number in the CdPN in lieu of sending the LRN in the CdPN and the Dialed Number in the GAP.

1.4 References

1) ANSI T1.113 - 1995, "American National Standards for Telecommunication Signaling System No. 7 (SS7) Integrated Service Digital Network (ISDN) User Part."

2) GR-1299-CORE, Issue 2 - Dec 1994, "AIN SCP/Adjunct Interface Generic Requirements"

3) Bellcore GR-1100-CORE, "Bellcore Automatic Message Accounting (BAF) Requirements", Issue 1, January, 1995; Revision 1, June 1995.

2. CUSTOMER PERSPECTIVE

2.1 End User Perspective (Human Interface)

The operation of this feature impacts the end-user even though end-user procedures are unchanged. There may be some intraswitch feature limitations when the end-user becomes interswitch. The end-user will be responsible for initiating the use of this feature. He/She will have to request to change services and/or service providers and still retain his/her DN. The end-user will also have the option to retain his/her DN following a location move within the rate center.

2.1.1 Feature Overview

Number Portability (NP) gives the end-user the ability to move from one switch to another and keep their original Directory Number (DN). There are 3 types of Number Portability - Service Portability, Service Provider Portability and Location Portability.

- Service Portability - allows an end user to retain his/her DN after changing services.

- Service Provider Portability - allows an end user to retain his/her DN after changing service providers.

- Location Portability - allows an end user to retain his/her DN after changing physical locations. In this case, the subscriber may or may not change service providers.

This feature will be based on AIN, and will follow the Bellcore AIN Release 0.1 protocol, with minor extensions drawn from GR-1299. This feature will introduce two new AIN triggers, either one of which can support all three types of Number Portability. This feature does not preclude the use of IN triggers to access the LNP database. When IN is used, the signaling follows the existing message set defined for tollfree service.

When an NPA-NXX is defined as portable (the coordination of line assignments is outside the context of this feature), the Service Control Point's (SCP) service logic will be defined to return a Location Routing Number (LRN) of the Recipient switch for the DNs that have been ported. When the switch receives the LRN, the LRN will be used to route the call to its correct destination. The LRN will be populated in the IAM's Called Party Number parameter. The actual dialed digits (plus implied Area Code) are in the Generic Address Parameter (GAP). The Forward Call Indicator (FCI) parameter in the ISUP Initial Address Message (IAM) will be used to indicate whether an LNP query was performed. This is used as a fail-safe mechanism to prevent more than one LNP query from being launched on a call.

When an NPA-NXX is portable, it can be assumed that the calls are all Intra-LATA Local or Intra-LATA Toll and the switch need not distinguish the types of calls based on whether the number was portable. The type of call is determined based on the analysis of the ported number.

Queries for non-ported DNs will cause the SCP to return the actual dialed DN and not the LRN. In this case, the dialed DN will be re-translated in the new LNP Routing Tables.

Switches that do not have LNP-SCP access capabilities will route the call to the donor switch or a tandem switch that has LNP-SCP access capabilities, and the donor or tandem switch will launch the query to determine routing.

Use of the PODP-like trigger to provide LNP leaves the AIN Release 0.1 protocol and functionality unchanged; no new TCAP parameters are required in this case. Use of the TAT-like trigger to provide LNP requires two additional TCAP parameters drawn from GR-1299.

The functionality provided by this feature is applicable only to calls encountering the LNP trigger. The functionality provided by this feature allows the switch to create an LNP Generic Address Parameter (GAP) for use in interswitch ISUP signaling and for LNP call routing operations.

The following statements pertain to this feature and the AIN or IN capabilities specified in this GR:

- This feature specifies a new AIN trigger or IN trigger operation which can be encountered within an SSP either prior to routing or during initial call routing.

- The feature specifies LNP Routing Tables for use in Digit Analysis for LNP-specific call routing.

- This feature specifies assignment of the LNP trigger based on one of the following:
  - the 3/6/10 digit Public Office Dialing Plan (PODP) trigger.
  - the TAT trigger on a six-digit NPA-NXX office-code.
  - the IN trigger currently used for tollfree service.

- Receipt of an SCP "Continue" in response to an LNP query shall be treated using existing AIN 0.1 procedures. Likewise, receipt of an "Authorize Termination" in response to an LNP query shall be treated using existing AIN 0.1 procedures. Both are unexpected responses from the LNP SCP. The SCP is expected to respond with either an Analyze Route, Forward Call, or ControlConnect message for both non-ported (with the Dialed Number) and ported (with the LRN) numbers for LNP based triggers.

- This feature also allows assignment of routes for use by the LNP-specific SCP Analyze_Route response or Forward Call response, or for LNP query failures.

- The LNP trigger will be encountered based on analysis of the dialed/received digits; however, the LNP query will be conditionally sent based on additional call routing determinations and checks (e.g., line resident on the switch).

- When the LNP trigger is assigned, all switch features should be supported for ported calls (unless otherwise noted in the document, see Assumptions (Section 1.2, Page 4) or Interactions and Transparencies with Other Features - Section 4.4.1). In particular, the following feature interactions will be supported:

  - CLASS Automatic Callback and Automatic Recall features will be operational when the LNP is encountered.

  - CLASS Screen List Editing (SLE) will be operational when the LNP is encountered.

  - The InterSwitch Voice Messaging (ISVM) feature will be operational when the LNP is encountered.

  - IntraLATA toll carrier selection will be operational when the LNP is encountered. If an interexchange carrier is used for the call, the LNP query will not be done.

- Location Routing Numbers (LRNs) will be provisioned to uniquely identify each switch in the LNP network.

- Default routing will be available for LNP triggers to allow the call to continue in the event that the SCP is unavailable or a fatal signaling error occurs. Default Routing will be applied if the SCP cannot be accessed due to abnormal circumstances. The default routing will be treated as if an Analyze_Route, Forward Call, or ControlConnect with the Dialed Number was returned from the SCP except the FCI indicator will be set to "number not translated".

- The AIN LNP trigger will follow the existing AIN serial triggering, and persistent transaction rules.

– The PODP trigger has precedence over PODP-based LNP trigger regardless of whether the PODP trigger has more or less specific digits. The PODP-based LNP trigger can be placed on the exact same digits as the PODP and the PODP will have precedence. The TAT trigger takes precedence over the TAT-based LNP trigger when both triggers apply to the terminating DN. The TAT-based LNP trigger can be encountered if an SCP "Authorize Termination" follows the TAT query.

2.1.2 Call Flows

For the following call flows, assume that the calls are handled by the LEC. If no IC is involved in the call, intraLATA SS7 signaling is used. No signaling changes are required for calls that involve IXCs since routing is done based on the carrier code.
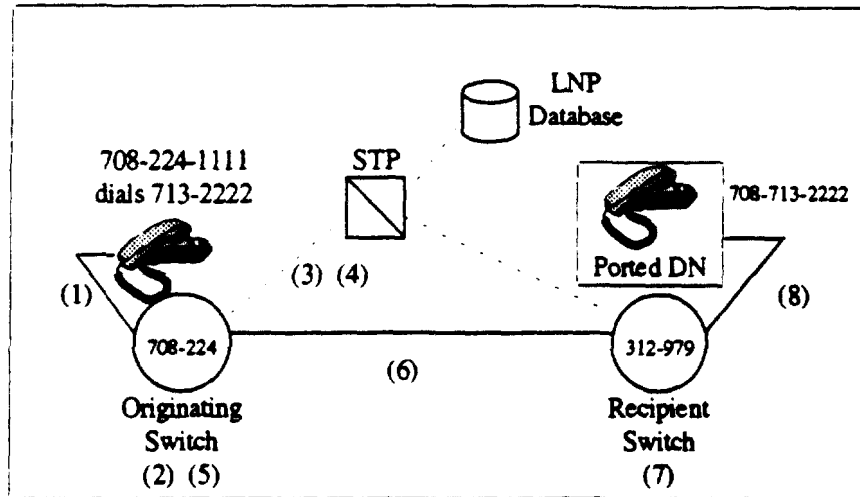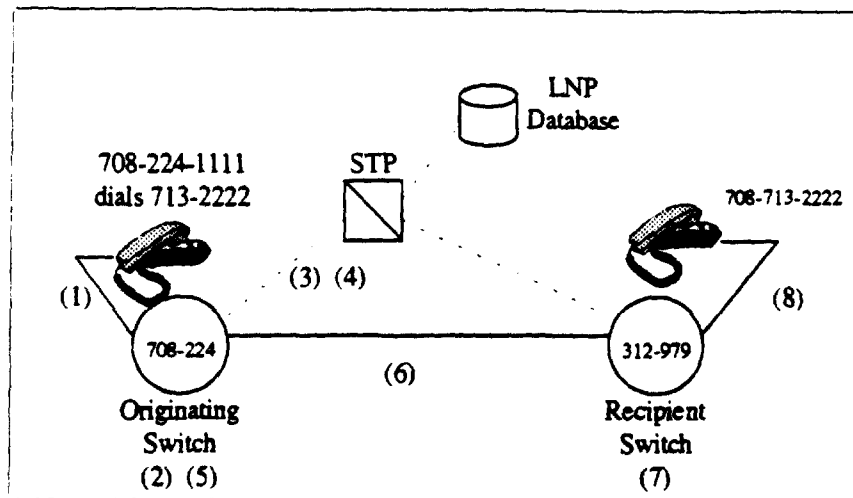

Figure 1 - Originating Switch LNP Processing Direct to Recipient Switch

Scenario A: Common case where a subscriber ports their number to a different switch and the subscriber can be connected via a direct connection. For this scenario, the Recipient switch can determine the subscriber's port without a database dip. The "Signal Ported Number" trunk group option is not specified for this scenario.

1. See Figure 1. Line A (708-224-1111) dials Line B (708-713-2222)

2. The Originating Switch performs digit analysis on the dialed digits to determine how to route the call. The switch determines that B is in a portable NPA-NXX (708-713) and the line does not reside on the switch.

3. The switch sends an AIN (Info_Analyze or Termination_Attempt) or IN (InstructionStart) query based on the dialed digits to the LNP-SCP.

4. The LNP-SCP sends an AIN (Analyze_Route or Forward_Call) or IN (ControlConnect) response containing the LRN of the Recipient Switch.

5. The Originating Switch receives the LNP-SCP response and analyzes the data. The LRN is translated in the LNP Routing Tables and an ISUP route out of the switch is determined. The LRN is stored in the CdPN parameter and the dialed digits are stored in the GAP parameter of the ISUP IAM message. The FCI Translated Called Number Indicator is set to indicate a query has been done (set to "translated number").

6. The call is routed to the Recipient Switch based on the LRN.

7. The Recipient Switch receives and processes the contents of the IAM message. The switch determines that an LRN is received and that it is the switch's LRN, and the switch replaces the CdPN parameter's contents with the dialed digits stored in the GAP parameter. The switch does digit analysis on the dialed digits and finds the subscriber on the switch.

8. The Recipient Switch completes the call to the subscriber.

Figure 2 - Originating Switch LNP Processing Direct to Recipient Switch - Non-Ported Case

Scenario B: This case is when the call is originated to the Recipient switch for a number that is not ported and still resides on the switch. Note, the same processing can be applied whether the call is incoming from a line or trunk.

1. See Figure 2. Line A (708-224-1111) dials Line B (708-713-2222)

2. The Originating Switch performs digit analysis on the dialed digits to determine how to route the call. The switch determines that B is in a portable NPA-NXX (708-713).

3. The switch sends an AIN (Info_Analyze or Termination_Attempt) or IN (InstructionStart) query based on the dialed digits to the LNP-SCP.

4. The LNP-SCP sends an AIN (Analyze_Route or Forward_Call) or IN (ControlConnect) response containing the Dialed Number to the Originating Switch. For example, the Dialed Number with Analyze_Route/Forward_Call response could be sent when the number is in a ported NPA-NXX but the subscriber has not ported. This allows the SCP to only have information about ported subscribers.

5. The Originating Switch receives the LNP-SCP response and analyzes the data. The dialed number is translated in the LNP Routing Tables and an ISUP route out of the switch is determined. The dialed number is stored in the CdPN parameter and the FCI Translated Called Number Indicator is set to indicate a query has been done (set to "translated number"). The GAP is NOT included in the IAM for this scenario.

6. The call is routed to the Recipient Switch based on the dialed number.

7. The Recipient Switch receives and processes the contents of the IAM message. The switch does digit analysis on the dialed digits and finds the subscriber on the switch.

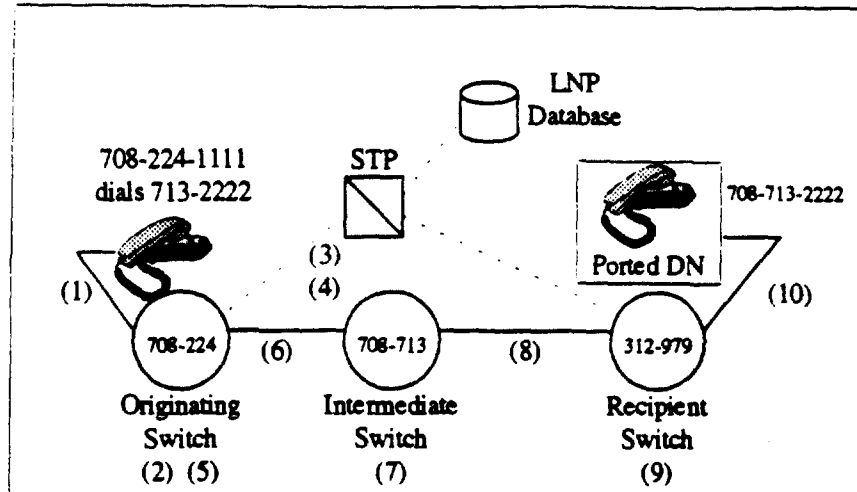8. The Recipient Switch completes the call to the subscriber.

Figure 3 - Originating Switch LNP Processing Indirect to the Recipient Switch

Scenario C: This is the case when an intermediate switch is between the originating switch doing the LNP database dip and the Recipient switch. This assumes that the call is a local call. The "Signal Ported Number" trunk group option is not specified for this scenario.

1. See Figure 3. Line A (708-224-1111) dials Line B (708-713-2222)

2. The Originating Switch performs digit analysis on the dialed digits to determine how to route the call. The switch determines that B is in a portable NPA-NXX (708-713).

3. The switch sends a query based on the dialed digits to the LNP-SCP.

4. The LNP-SCP sends a response message containing the LRN of the Recipient Switch.

5. The Originating Switch receives the LNP-SCP response and analyzes the data. The LRN is translated in the LNP Routing Tables and an ISUP route out of the switch is determined. The LRN is stored in the CdPN parameter and the dialed digits are stored in the GAP parameter of the ISUP IAM message. The FCI Translated Called Number Indicator is set to indicate a query has been done (set to "translated number").

6. The call is routed to the Intermediate Switch based on the LRN.

7. The Intermediate Switch receives and processes the contents of the IAM message. The FCI is set and the CdPN is checked for an LRN on this switch. The LRN does not belong to this switch so the call is routed using existing ISUP procedures.

8. The Intermediate Switch routes the call to the Recipient Switch based on the LRN.

9. The Recipient Switch receives and processes the contents of the IAM message. The switch determines that the LRN is its LRN and replaces the CdPN parameter's contents with the dialed digits stored in the GAP parameter. The switch does digit analysis on the dialed digits and finds the subscriber on the switch.

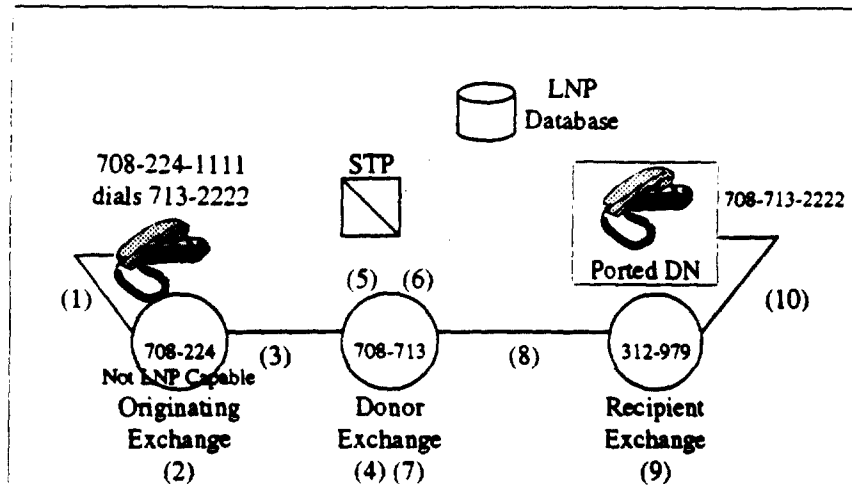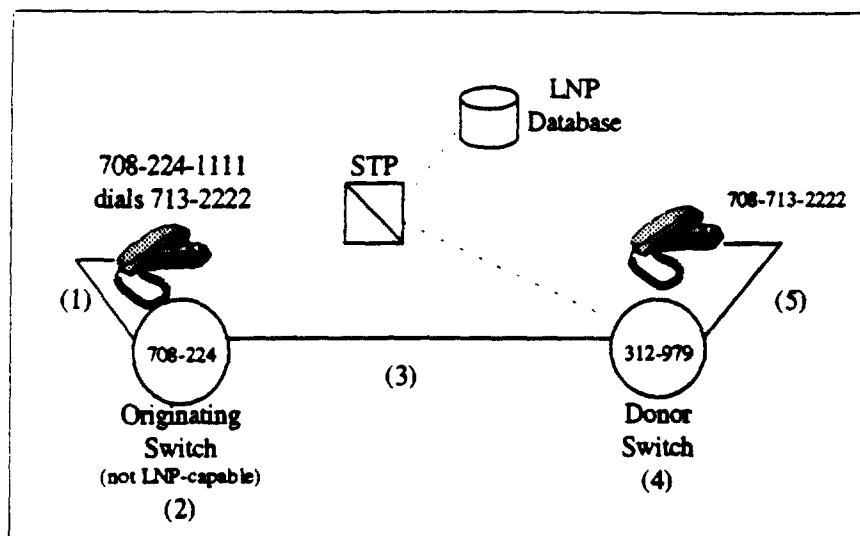10. The Recipient Switch completes the call to the subscriber.

Figure 4 - Donor Switch with LNP Query

Scenario D: This is the case when the originating switch does not recognize the dialed number as a ported number and routes normally to the donor switch. The donor switch recognizes the ported number. The donor switch will perform the dip and direct the call to the Recipient switch. The "Signal Ported Number" trunk group option is not specified for this scenario.

1. See Figure 4. Line A (708-224-1111) dials Line B (708-713-2222).

2. The Originating Switch performs digit analysis on the dialed digits to determine how to route the call.

3. The call is routed to the Donor Switch based on the dialed number (Originating Switch is not involved in NP).

4. The Donor Switch performs digit analysis on the dialed digits to determine how to route the call. The switch determines that B is in a portable NPA-NXX (708-713).

5. The Donor Switch sends a query based on the dialed digits to the LNP-SCP.

6. The LNP-SCP sends a response back to the donor switch containing the LRN of the Recipient Switch.

7. The Donor Switch receives the LNP-SCP response and analyzes the data. The LRN is translated in the LNP Routing Tables and an ISUP route out of the switch is determined. The LRN is stored in the CdPN parameter and the dialed digits are stored in the GAP parameter of the ISUP IAM message. The FCI Translated Called Number Indicator is set to indicate a query has been done (set to "translated number").

8. The call is routed to the Recipient Switch based on the LRN.

9. The Recipient Switch receives and processes the contents of the IAM message. The switch determines that the LRN is its LRN and replaces the CdPN parameter's contents with the dialed digits stored in the GAP parameter. The switch does digit analysis on the dialed digits and finds the subscriber on the switch.

10. The Recipient Switch completes the call to the subscriber.

Figure 5 - Donor Switch with Non-Ported Number

Scenario E: This case is when a call is originated at the originating switch for a number that is not ported and still resides on the donor switch. The originating switch is not LNP capable.
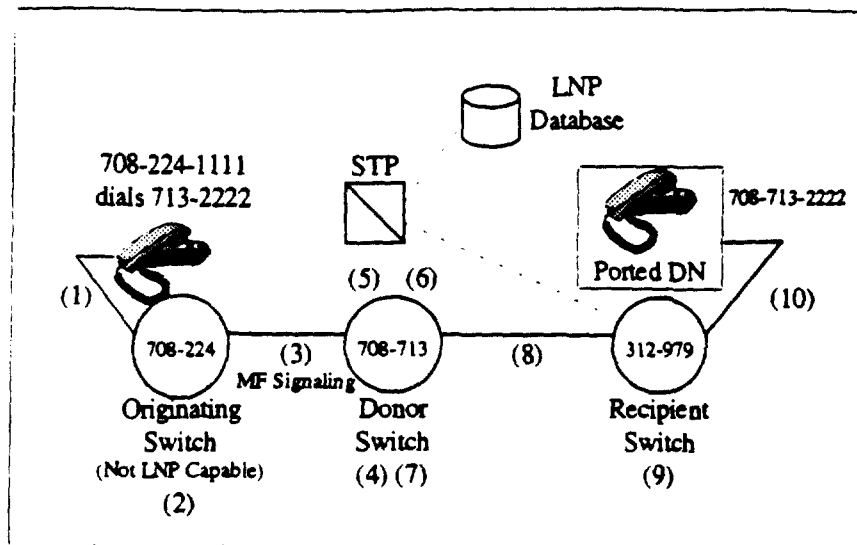
1. See Figure 5. Line A (708-224-1111) dials Line B (708-713-2222)

2. The Originating Switch performs digit analysis on the dialed digits to determine how to route the call.

3. The call is routed to the donor switch based on the dialed number (Originating Switch is does not use LNP and the donor switch still has this particular subscriber).

4. The Donor Switch performs digit analysis on the dialed digits to determine how to route the call. The switch determines that B is in a portable NPA-NXX (708-713) and finds the subscriber since B has not been ported.

5. The Donor Switch completes the call to the subscriber.
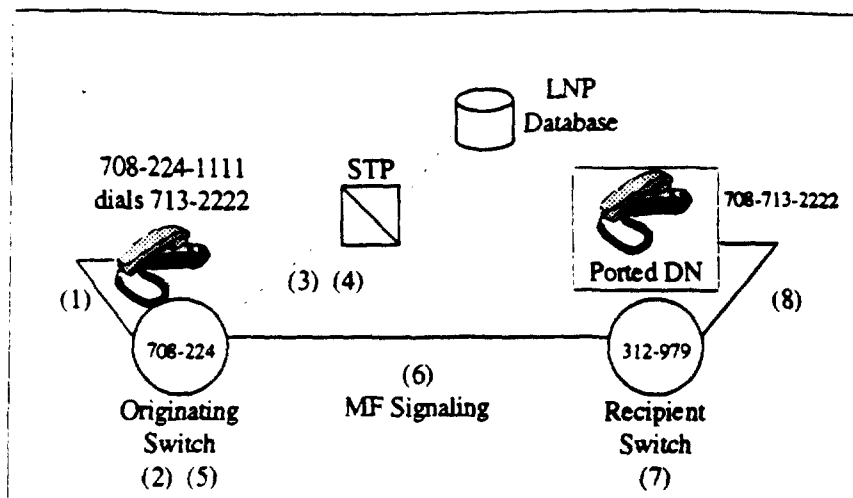
Figure 6 - Originating Switch with LNP Query and Outgoing MF Signaling

Scenario F: This is the case when a subscriber moves to a switch but the call encounters MF signaling between the switch making the LNP database dip and the Recipient switch.
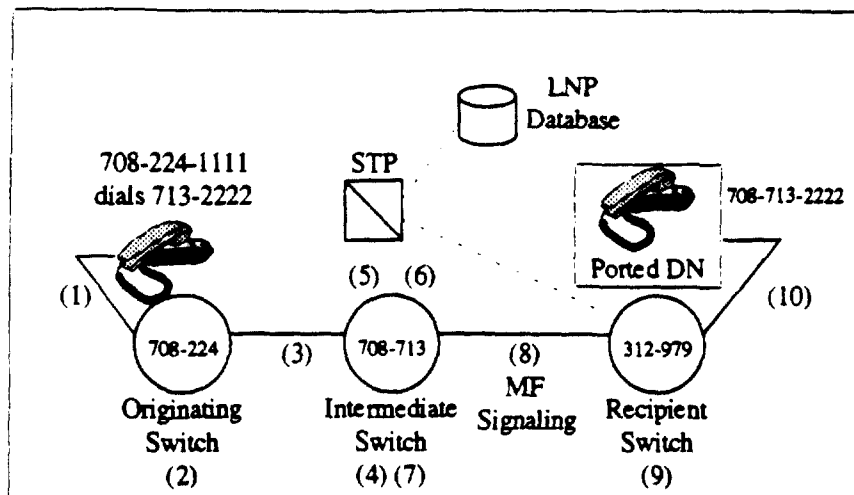
1. See Figure 6. Line A (708-224-1111) dials Line B (708-713-2222)

2. The Originating Switch performs digit analysis on the dialed digits to determine how to route the call. The switch determines that B is in a portable NPA-NXX (708-713) and that B is not on the switch.

3. The switch sends a query based on the dialed digits to the LNP-SCP.

4. The LNP-SCP sends a response containing the LRN of the Recipient Switch.

5. The Originating Switch receives the LNP-SCP response and analyzes the data. The LRN is translated in the LNP Routing Tables and determines an MF route out of the office.

6. The Originating Switch signals, using MF signaling, the dialed number (not the LRN) to the Recipient switch using existing procedures.

7. The Recipient Switch performs digit analysis on the incoming digits to determine how to route the call and determines that the line is on the switch.

8. The Recipient Switch completes the call to the subscriber.

Figure 7 - Donor Switch with LNP Query and Incoming MF Signaling

Scenario G: For this case, the LNP trigger is encountered for digits received via a trunk. The "Signal Ported Number" trunk group option is not specified for this scenario.
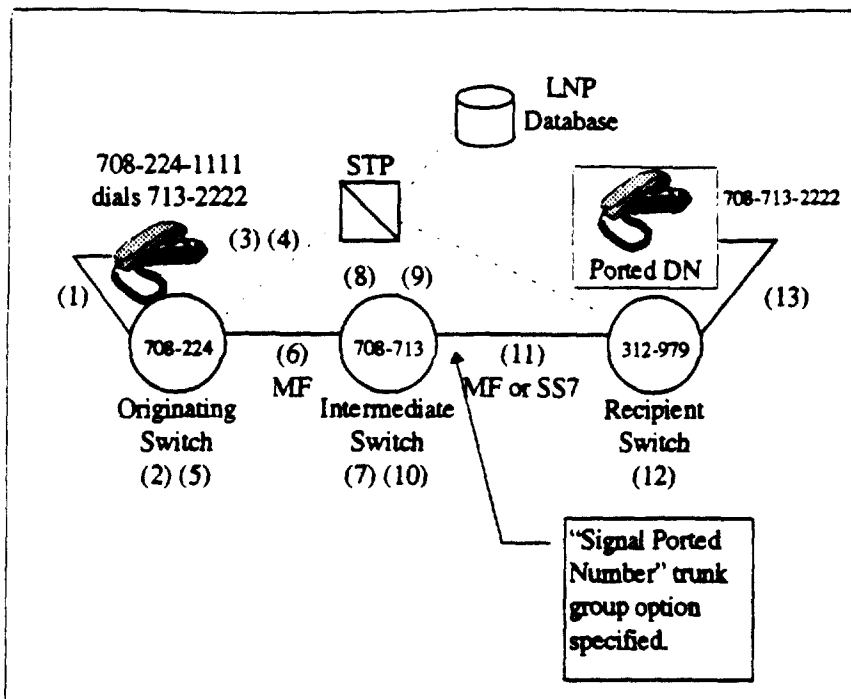
1. See Figure 7. Line A (708-224-1111) dials Line B (708-713-2222)

2. The Originating Switch, which is not LNP capable, performs digit analysis on the dialed digits to determine how to route the call.

3. The call is sent to the Intermediate (also the Donor Switch) switch via MF signaling.

4. The Intermediate Switch performs digit analysis on the incoming digits to determine how to route the call. The switch determines that B is in a portable NPA-NXX (708-713) and the subscriber is not on the switch.

5. The switch sends a query based on the dialed digits to the LNP-SCP.

6. The LNP-SCP sends a response containing the LRN of the Recipient Switch.

7. The Intermediate Switch receives the LNP-SCP response message and analyzes the data. The LRN is translated in the LNP Routing Tables and an ISUP route out of the switch is determined. The LRN is stored in the CdPN parameter and the dialed digits are stored in the GAP parameter of the ISUP IAM message. The FCI Translated Called Number Indicator is set to indicate a query has been done (set to "translated number").

8. The call is routed to the Recipient Switch based on the LRN.

9. The Recipient Switch receives and processes the contents of the IAM message. The switch determines that the LRN is its LRN and replaces the CdPN parameter's contents with the dialed digits stored in the GAP parameter. The switch does digit analysis on the dialed digits from the GAP and finds subscriber on the switch.

10. The Recipient Switch completes the call to the subscriber.

Figure 8 - Intermediate Switch with LNP Query and Outgoing MF Signaling

Scenario H: For this case, the LNP trigger is encountered for digits received via a trunk. The call is routed via MF signaling to the recipient switch that has the subscriber.

1. See Figure 8. Line A (708-224-1111) dials Line B (708-713-2222)

2. The Originating Switch performs digit analysis on the dialed digits to determine how to route the call. It routes the call to the Intermediate Switch (Originating Switch is not LNP-capable).

3. The Originating Switch selects an ISUP trunk to the Intermediate switch and signals using existing ISUP procedures.

4. The Intermediate Switch performs digit analysis on the incoming digits to determine how to route the call. The switch determines that B is in a portable NPA-NXX (708-713) and that B is not on the switch.

5. The switch sends a query based on the dialed digits to the LNP-SCP.

6. The LNP-SCP sends a response containing the LRN of the Recipient Switch.

7. The Intermediate Switch receives the LNP-SCP response and analyzes the data. The LRN is translated in the LNP Routing Tables and an MF route out of the switch is determined. The LRN is replaced with the dialed digits for signaling MF to the Recipient Switch.

8. The Intermediate Switch signals, using MF signaling, the dialed digits to the Recipient switch.

9. The Recipient Switch processes the incoming call to find the subscriber.

10. The Recipient Switch completes the call to the terminating subscriber.

Figure 9 - Incoming MF to Intermediate Switch with LNP Query and Outgoing MF or SS7 Signaling

Scenario I: For this case, the LNP trigger is encountered for the dialed digits and the call is routed through an intermediate switch (also the donor) via an MF trunk. The intermediate switch requires a second LNP database dip to route the call to a non-LNP capable switch using the "Signal Ported Number" trunk group option to complete the call to the correct subscriber. The call is routed via MF or SS7 signaling to the switch that has the subscriber.

1. See Figure 9. Line A (708-224-1111) dials Line B (708-713-2222)

2. The Originating Switch performs digit analysis on the dialed digits to determine how to route the call. The switch determines that B is in a portable NPA-NXX (708-713) and that B is not on the switch.

3. The switch sends a query based on the dialed digits to the LNP-SCP.

4. The LNP-SCP sends a response containing the LRN of the Recipient Switch.

5. The Originating Switch (in this example, this switch is also the donor) receives the LNP-SCP response and analyzes the data. The LRN is translated in the LNP Routing Tables and determines an MF route out of the office.

6. The Originating Switch signals, using MF signaling, the dialed number (not the LRN) to the intermediate switch using existing procedures.

7. The Intermediate Switch (also the donor switch in this case) performs digit analysis on the incoming digits to determine how to route the call. The switch determines that B is in a portable NPA-NXX (708-713) and that B is not on the switch.

8. The switch sends a query based on the dialed digits to the LNP-SCP.

9. The LNP-SCP sends a response containing the LRN of the Recipient Switch.

10. The Intermediate Switch receives the LNP-SCP response and analyzes the data. The LRN is translated in the LNP Routing Tables and an MF or ISUP route out of the switch is determined. Since the "Signal Ported Number" trunk group option is set, the LRN is replaced with the dialed digits for signaling to the Recipient Switch.

11. The Intermediate Switch signals, using MF or SS7 signaling, the dialed digits in the IAM CdPN to the Recipient switch. The IAM will not contain a "ported number" GAP and the FCI will not be set.

12. The Recipient Switch processes the incoming call to find the subscriber using normal switch processing.

13. The Recipient Switch completes the call to the terminating subscriber.

2.2 Service Provider Perspective

The following scenarios need to be facilitated:

I. Provisioning the LNP Routing Tables

II. The service provider "A" customer ports his/her number to service provider "B."

III. A customer in a Number Portability network discontinues his/her service.

2.2.1 Operational User

Operations personnel are responsible for providing the resources - administration, provisioning, maintenance and billing for customers who desire to change their current subscriber arrangement due to service, service provider, or location changes. This process should be as transparent as possible to the end-user with minimal disruption of service. The operations personnel or third-party administration will be responsible for updating the databases efficiently as numbers get ported.

2.2.2 Operational User Scenarios

The below description is provided as background information. See the LNP SMS General Description and Requirements document -- *for further study.*

Provisioning of LNP Routing Tables

A) LRN translations with the associated route that will route to the office owning the LRN.

B) The service providers shall have the ability to specify the LRN that identifies the switch. At least 2 LRNs (NPA-NXXs) must be supported on a switch per LATA. One LRN identifies the switch or "point of presence" for the service provider and the other is used for maintenance purposes (e.g., switch replacement).

C) Translations for routing for when the dialed DN or LRN is returned from the SCP. These translations would normally route to the donor switch.

D) Translations for routing when the SCP is unavailable. The switch shall treat this situation as though an Analyze_Route or Forward_Call with the Dialed Number was returned from the SCP. These translations would normally route to the donor switch.

Provisioning Sequence for Porting Subscribers

See the LNP SMS General Description and Requirements document and the LNP Operation Description - *- for further study by the SMS Subcommittee and the Operations Subcommittee.*

3. NETWORK IMPACTS

3.1 Security Issues
There are no security issues identified.

3.2 Other Switching Systems
This feature is a cross-switch feature.

3.3 Signal Transfer Point (STP)
The STP may need to be updated to handle 10-digit Global Title Translations (GTT) and existing procedures can be used to support 10-digit GTT on the STP. An alternative is to provision the STP to support an intermediate 6-digit GTT to direct the SCCP messages to the SCP for 10-digit GTT. This would minimize provisioning in the STP and centralize subscriber changes in the SCP. There are no STP protocol modifications.

Existing TCAP routing procedures apply between the switch and the STP. A new translation type may be used for LNP queries for identification purposes.

3.4 Service Control Point (SCP)
The SCP is impacted to support the database functions needed for number portability. Below are the possible general database data attributes that can be stored in the SCP and related to the dialed number:

- Point Code for 10-digit GTT

- Service Provider ID

- Location Routing Number

- V&H coordinates or equivalent

- LIDB Point Code for Dialed Number

The SCP requirements will be produced in a separate GR document to be generated by the SCP subcommittee.

3.5 Service Management System (SMS)

The Service Management System can be used as a central database for subscriber information and downloaded to the SCPs. This interface is for further study.

3.6 Operations Systems Impacts
The Operations Systems Impact is outside the scope of this document and a reference document *is for further study.*

3.7 Operator Network Elements

The Operator network elements will be impacted by this feature and will need to access the SCP for information on the LIDB regarding where the subscriber is located in the network. The Operator Systems

requirements will be produced in a separate GR document. There is no known impact to the interface between the End Office and the Operator Network Elements when portability is defined within a rate center.

3.8 Customer Premises Equipment (CPE) and User Equipment Needs and Impacts

No CPE needs and/or user equipment needs and impacts have been identified.

3.9 Cellular Service Providers

The requirements for porting wireless subscribers to landline subscribers and visa versa is outside the scope of this document. This document defines any new requirements for switching and signaling for calls to/from portable subscribers.

3.10 Toll Network Interface

3.10.1 Originating LATA

No new requirements have been specified for signaling to an Interexchange carrier in the originating LATA. When the carrier is selected by the subscriber, either dialed or implied via carrier presubscription, the call shall be routed to the carrier without an LNP query.

3.10.2 Terminating LATA

The LNP requirements specified in this document apply when an interexchange carrier routes a call into the terminating LATA. The IXC may send the LRN, GAP, and FCI indicator to the terminating LATA service provider. If so, the service provider shall process the call using the LNP procedures.

3.11 Interactions with Non-LNP Capable Switches.

The document describes the interfaces within the context of the LNP-capable switch. See the Call Flows (section 2.1.2) for example interfaces. No new interface or signaling requirements are needed in non-LNP capable switches.

4. FEATURE REQUIREMENTS

This section defines the feature requirements for Number Portability. The requirements are highlighted in "tags" to facilitate requirements traceability. Each tag in the document has a label containing a unique number (e.g., <REQ-IL-GR-90V1> where REQ-IL-GR is the document, 90 is the number, and V1 is the "version number) which identifies the specific requirement.

Most of the requirements specified in this document are considered "required" (e.g. essential) to support an initial offering of Service Provider portability. Such requirements are tagged with "REQ". Requirements which are seen as necessary to provide a robust solution for Service Provider portability (especially in regards to billing capabilities) are marked as "FUT" to indicate they may be provided in a future software release or generic beyond that which contains the initial functionality for Number Portability. There is also a third class of requirement "OPT", or optional. These are requirements that may be desired by some, but not all service providers, and as such are left to individual service providers to choose as necessary.

4.1 Call Processing Requirements

There are basic considerations with respect to LNP service provisioning on the switches that should be noted in reading the following requirements:

1. A switch using the LNP trigger for LNP must open up and build out a new office code when it receives its first DN in that office code. A switch using the TAT-based LNP trigger must open an office code when the associated NPA-NXX is designated as portable, and must build out the office code on receipt of its first DN in that office code. In either case, lines are provisioned as they port onto the switch.

2. When a line moves off an established switch serving a given NPA-NXX, the Donor switch will need to perform an LNP query in order to route the call to the former customer correctly. The switch must allow an LNP trigger to be placed against the ported NPA-NXX.

3. The switch will contain a list of at least 2 NPA-NXXs that are designated the LRN for this switch. When calls are received, the switch will compare received LRNs with its own LRNs. When they match, the switch will use the "ported number" GAP to connect to the subscriber.

The LNP trigger:
Through-out these requirements, the term LNP trigger is used to refer to the LNP trigger detection and SCP response processing. The LNP trigger is defined as an AIN 0.1 based trigger that is assigned identically to the PODP or TAT based trigger. The LNP trigger can be defined as an IN based trigger that is assigned identically to the "tollfree" based IN trigger. The rules on when call processing can encounter the LNP trigger follow the AIN 0.1 or IN rules with exceptions as noted. Unlike other triggers, the LNP trigger will initiate a query to the SCP based on additional call processing checks after the trigger is initially encountered. In other words, the LNP trigger is a conditional trigger and the operation will have the following functional components that are enhancements to the current AIN 0.1 or IN trigger.

The TAT-based LNP Trigger is a new trigger administered against office codes (i.e., six-digit NPA-NXX codes) that are open on the switch. The switch detects an LNP trigger at the termination attempt on a call to a DN within one of the designated office codes. The DN need not be associated with line equipment for this trigger to be encountered. Escape criteria can be administered against the LNP trigger to prevent a query from taking place when the trigger is encountered. Within this document, the TAT-based LNP trigger is an LNP trigger and follows the LNP general requirements unless otherwise noted.

The Functional Components Required in Support of LNP:

1. **Conditional LNP Trigger:**
   The LNP trigger is a conditional trigger which will initiate a query based on further routing determinations and checks following the trigger detection.

2. **Multiple LNP Routing Tables:**
   The LNP trigger response processing will make use of new Routing Tables, termed the "LNP Routing Tables." The LNP Routing Tables will be used in processing the SCP message received in response to an LNP query. The LNP Routing Tables may be assigned for use on a per trigger basis; alternately, the appropriate LNP Routing Tables may be selected based on the attributes of the triggering agent.

3. **LNP Location Routing Number (LRN):**
   The switch will be provisioned with the LRNs which can be used to uniquely identify the switch. The switch must support at least 2 NPA-NXXs that identify an LRN for this switch.

4. **Non-Ported Subscriber Response Processing:**
   The Analyze_Route, Forward_Call, or ControlConnect message containing the Dialed Number within the CalledPartyID parameter will be received in response to the LNP query for a non-ported subscriber. This response will result in the retranslation of the *CalledPartyID* using the LNP Routing Tables.

5. **LNP Trigger Default Routing:**
   Default Routing will cause the dialed number to be reanalyzed in the LNP Routing Tables similar to receiving an Analyze_Route, Forward_Call, or ControlConnect message with the dialed number. For default routing, the FCI is set to "number not translated" and "ported number" GAP are not included in the IAM.

6. **LNP GAP Creation:**
   When the LNP trigger results in a query which returns an Analyze_Route message with the CalledPartyID different from the dialed digits, and the call proceeds, then the SSP must generate a "Number Ported" Generic Address Parameter (GAP) for use in routing calls to ISUP trunks. When a call to a ported DN encounters the TAT-based LNP trigger, the resulting Forward_Call message shall contain an LRN in the CalledPartyID, and the ported DN in the GenericAddressListParameter. The switch shall map the GenericAddressParameter to a "Number Ported" GAP in the outgoing ISUP IAM message. The GAP creation is dependent upon the "Signal Ported Number" trunk group option not being specified.

7. **ISUP LNP Parameter Support:**
   ISUP signaling will support the transport of an "ported number" GAP as well as an LNP DB query indication. The LNP DB query indication will be provided using the ISUP Forward Indication (FCI) parameter. The originating, intermediate (including donor), and terminating switches will be able to detect and process these LNP parameters.

8. **LNP Trigger & PODP Trigger Interactions:**
   The LNP PODP trigger can coexist with PODP triggers and have matching and/or overlapping digit patterns. The PODP trigger will always have precedence over the LNP trigger and the LNP trigger will be encountered if routing continues to the number that initiated the first trigger.

9. **TAT-Based LNP Trigger and TAT Interactions:**
   The TAT-based LNP Trigger can coexist with TAT and have overlapping digit patterns. The TAT always has precedence over the LNP trigger. TAT-based LNP Triggers may be encountered if the response to a TAT query is Authorize Termination.

10. **LNP Trigger & Switch-Based Feature Interactions:**
The LNP trigger can coexist with other existing switch features (i.e., CLASS Automatic Recall (AR) and Automatic Callback (AC) features) without altering the operation from an end user's perspective.

11. **LRN Detection and Processing:**
Recipient Switches shall be able to identify the switch's LRN and replace the Called Party Number with the "ported number" GAP address information. The dialed number (not the LRN) can be used to connect to the appropriate line or trunk.

12. **Trunk Option for Signaling Ported Number:**
An originating or intermediate switch shall support a per trunk group option for signaling the ported number instead of the LRN as the called party for ISUP trunks. The intermediate switch will route through the switch using the LRN (since the LRN is not it's own LRN). When the SS7 outgoing trunk is selected, the switch will use the GAP information, after proper digit editing, to formulate the Called Party Number in the IAM. The FCI shall be set to "Number not translated" and the GAP shall not be included.

Any line or trunk call origination can encounter the new LNP trigger.

Multiple LNP Routing Tables: The LNP trigger responses will be processed using routing tables provisioned specifically for use with LNP call routing. The use of LNP Routing Tables will facilitate the following LNP functions:

I. LNP Routing Tables allow the SCP to return the LNP SCP Response with the Dialed Number in the CalledPartyID parameter (dialed digit retranslation) for calls that encounter the LNP trigger and the SCP returns the response with Dialed Number as an indication that it has no record that the called user has been ported. When the switch receives this response to an LNP query, the switch will be able to retranslate the dialed number using new Routing Tables. While the originators Routing Tables did not point to an interoffice route, the LNP Routing Tables can be provisioned to send the call to another switch.

II. LNP Routing Tables facilitate default routing by allowing calls, that can not be routed intraswitch when the SCP fails, to be routed to the donor switch during database unavailability intervals.

Below is Figure 10 to illustrate the need for LNP routing tables. If a subscriber on the switch dialed a 708-111-1112, digit analysis would yield a DN that is not resident on the switch denoted as an "unallocated number". Since the 708-111 is a portable NPA-NXX, the LNP query is sent to the SCP. The SCP response could be the Dialed Number if the subscriber was not ported and still on the donor switch. In this example, digit analysis in the normal line/trunk routing tables would yield a vacant code and the call would fail. If a new LNP routing table is used, the analysis of the Dialed Number would yield a route to the donor switch resulting in proper treatment for the call. No specific implementation is suggested by the figure or by the example.
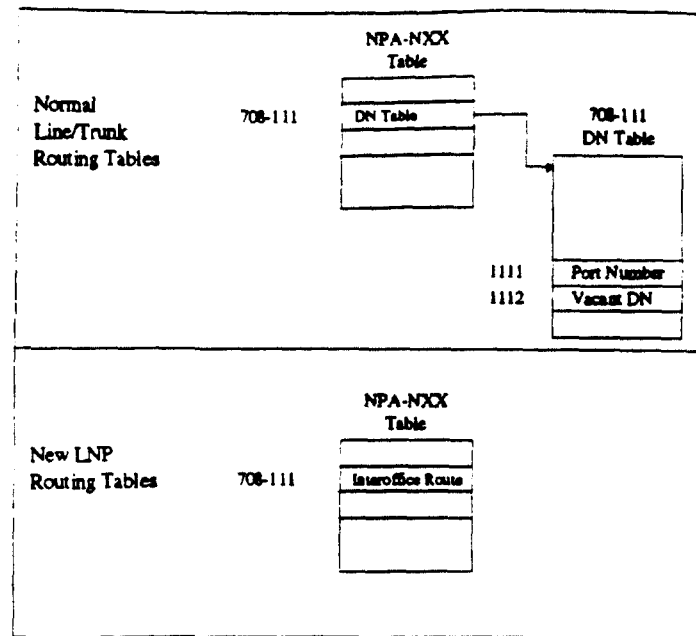
Figure 10 - LNP Routing Tables

<REQ-IL-GR-20V1>
New Routing Tables will be defined and provisioned for use by this feature. The new Routing Tables will be called the LNP Routing Tables and used to provide a route for post-query processing for an LNP trigger.

The switch must have the means to select a route based on the line or trunk's dialing plan and select a different route based for the same digits after an LNP query.
<End of REQ-20>

4.1.1 LNP Trigger Detection and Processing

4.1.1.1 LNP Query
Given that the LNP trigger is assigned, when call processing encounters the LNP trigger, the SSP will first make a determination based on the trigger assignment data and/or a look-ahead in routing to decide whether to generate a query or ignore the trigger. The additional pre-query checks allow the switch to avoid querying when LEC routing is indicated.

The LNP trigger is a conditional trigger which can be encountered by calls from lines or trunks; however, the LNP query is launched only if additional criteria is satisfied for the call.

Given the LNP trigger is encountered for the Called Party DN, the following is criteria on whether or not a query should be launched:

1. Do not launch the LNP query if a subscriber exists for the Called Party Number on the switch, and LEC routing is being implicitly or explicitly requested for the call.

2. Launch the LNP query if the Called Party Number belongs to one of the NPA-NXXs served by the office, and LEC routing is being implicitly or explicitly requested for the call, and a subscriber does not exist.

3. Do not launch the LNP query if the call is routed to an operator system or interexchange carrier.

4. In all cases above, do not launch the LNP query if an LNP query was already made for the call or if the serial triggering limit is exceeded.

In addition, there are a number of cases where the LNP trigger will either not be encountered or will be bypassed based on the dialed number. These cases are covered in requirements found elsewhere in this GR.

Lastly, there are some cases where the LNP triggers will be bypassed or the call will receive reorder treatment as an inherited characteristic from the AIN trigger operation specified in Bellcore AIN requirements. Many of these cases are related to interactions with switch based feature operation. These cases are being identified and unless specified in this GR, LNP trigger interactions will be limited to the analogous AIN or IN trigger interaction for this release.

The following requirements address the conditional nature of the LNP query.

<REQ-IL-GR-10V1>
With respect to call processing, the LNP trigger can be encountered at an originating, intermediate, or terminating switch.
<End of REQ-10>

<REQ-IL-GR-810V1>
The SSP shall support the administration of a six-digit LNP trigger against the SSP. As an objective, the SSP shall support the administration of the LNP trigger against more specific digit patterns: NPA-NXX-X, NPA-NXX-XX, NPA-NXX-XXX, or NPA-NXX-XXXX.

For a TAT-based LNP Trigger, the NPA-NXX will correspond to an open office code on the switch.
< End of REQ-810>

<REQ-IL-GR-30V1>
If an LNP trigger is encountered, and the dialed/called number is not served by the switch, and the FCI[2] does not indicate "Number Translated" then an LNP query should be made and sent to the SCP.

The expected LNP queries messages are as follows:
1. Info_Analyze message for a POPD-based LNP trigger
2. Termination_Attempt message for a TAT-based LNP trigger
3. ControlConnect message for an IN-based LNP trigger

The query message is sent to the SCP, and the message parameter population rules are based on existing population rules unless otherwise noted in this GR.
<End of REQ-30>

The LNP trigger is a conditional trigger with the following triggering determination strategy:

If it can be determined prior to launching the query that the call:

- Is intraswitch (the subscriber is on the switch),
- a previous LNP query has not been done,
- is not routing to an Interexchange Carrier (IXC), and

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[2] FCI refers to the Forward Call Indicators included in the ISUP protocol. The FCI values will be discussed in detail in later sections. The setting of "Number Translated" means that an LNP trigger has been successfully encountered on the call.

– is not routing to an operator system

then the LNP query will not be launched.

<REQ-IL-GR-40V1>
An LNP Query shall be sent when ALL the following apply:
1. When the incoming trunk is MF or when the FCI for an ISUP trunk indicates that the number is not translated. This item does not apply to an originating switch.
2. When the called number has an LNP trigger.
3. When the called number is not served by this switch.
4. When the route is not destined for an operator.
5. When the call is not to an interexchange carrier.
<End of REQ-40>

<REQ-IL-GR-70V1>
If an LNP trigger is encountered and IXC routing (non-LEC) is assured prior to launching the LNP query, the LNP query should be bypassed, and the call routed to the predialed carrier, or presubscribed carrier (PIC), or group carrier, or lastly to the Office provisioned interLATA carrier. If the carrier is not allowed to handle the call, the call will receive the current error handling treatment (routed to an announcement).
<End of REQ-70>

<REQ-IL-GR-75V1>
If an LNP trigger is encountered and the call is destined for an operator system, the LNP query should be bypassed and the call should be routed to the operator system.
<End of REQ-75>

<REQ-IL-GR-90V1>
If an incoming ISUP call includes an FCI indication of "Number Translated", and a second LNP trigger is encountered, the second LNP trigger should be ignored and the call continue as if the second LNP trigger was not encountered.

FCI and "Ported Number" GAP will remain unchanged.
<End of REQ-90>

<REQ-IL-GR-830V1>
The PODP shall take precedence over the PODP-based LNP trigger. If the PODP query results in a "Continue" response, the LNP trigger shall be encountered if its trigger criteria are satisfied.
< End of REQ-830>

<REQ-IL-GR-840V1>
The TAT shall take precedence over the TAT-based LNP trigger. If a TAT query results in an Authorize Termination response, the LNP trigger shall be encountered if its trigger criteria are satisfied.
< End of REQ-840>

4.1.1.2 Trigger Response Processing

<REQ-IL-GR-110V1>
If an LNP trigger is encountered, and the query is sent to the SCP, if the LNP response message is received from the SCP without error, the LNP Routing Tables will be used for digit analysis of the LNP Response message.

The expected LNP SCP responses are:
1. Analyze_Route for a PODP-based trigger.
2. Forward_Call for a TAT-based trigger.
3. Control_Connect for an IN-based trigger.

If the SCP returns an AIN Send_To_Resource message(s), then the Analyze_Route/Forward_Call message returned following the Send_To_Resource session(s) will also be translated using the LNP Routing Tables for analysis of the Called_Party_ID information element.

The route will be determined from digit analysis. The ANI are derived from any previous triggers, else from the originating facility. The response does not change the ANI information unless the SCP provides a new ANI (existing AIN requirements).
<End of REQ-110>

The Called Party DN received in the LNP response message will be retranslated using the LNP Routing Tables. This allows the service providers to set up routing of LNP calls using the LNP Routing Tables. The LNP Routing Tables provisioning will also allow the service provider to:

- handle an SCP response message with the providers own LRNs as the Called Party ID.
- handle an SCP response with the Dialed Number message and retranslate the dialed DN in the LNP routing tables.
- allow an LNP call to be delivered to a DN (or vacant code announcement) or delivered to a carrier following the LNP query.

4.1.1.2.1 Routing to Own LRN Following the LNP Query
The Called Party DN, if different from the dialed DN received in the LNP response message will be compared against the LRNs assigned to the originating switch. If the Called Party Number matches one of the originating switch LRNs, the call will be routed to the dialed number and the LRN dropped.

<REQ-IL-GR-120V1>
Prior to routing on the LNP response, a check will be made to determine if the received CalledPartyID is an LRN value owned by the switch. If it is, the LRN will be dropped and the call will be routed to the dialed number based on the LNP response in the LNP routing tables.

No "Ported Number" GAP will be created and the FCI will be set to "translated number".
<End of REQ-120>

4.1.1.2.2 SCP Provided Trunk Value
Current AIN rules will apply if the SCP returns an Analyze_Route message with valid Trunk Group parameter.

If valid trunk group parameters are returned (Primary, Alternate, SecondAlternate Trunk Group), then the SSP will route the call to the specified trunk group without further digit analysis of the CalledPartyID. When the LNP trigger is launched, and the SCP returns valid Trunk Group parameters, the SSP will attempt to route to the provided Trunk group without LNP response processing.

This section does not apply to IN-based LNP triggers.

4.1.1.2.3 LNP Trigger Response Processing - AIN "Continue" or "Authorize_Termination" Response
The SSP does not expect to receive an AIN "Continue" or "Authorize_Termination" message from the LNP SCP; nevertheless, the SSP shall accept and process this message according to the procedures outlined in AIN Release 0.1.

4.1.1.2.4 LNP Trigger Impact on Switch Based Call Redirection Information

The LNP query should not modify the switch values for the Original Called Party and/or Redirecting Party. That is, the LNP operation should not alter the call redirection information and party DNs that are used by the switch-based features. No new requirements have been specified for the LNP capability. This section does not apply to IN-based LNP triggers.

<REQ-IL-GR-170V1>
The LNP trigger should not manipulate the SSP values for the Original Called Party DN and Redirecting Party DN unless specifically indicated by the inclusion of the *RedirectingPartyID* parameter in the SCP response.

The LNP query should not increment the call forwarding redirection counter unless specifically indicated by the inclusion of the *RedirectionInformation* parameter in the SCP response.

If the LNP query message contains the *RedirectingPartyID* and/or *RedirectionInformation* parameters, the SSP should treat them using existing AIN requirements.

The rest of the AIN 0.1 Analyze_Route message parameters which are received on an LNP query should be honored as per the AIN 0.1 requirements.
<End of REQ-170>

4.1.1.2.5 LNP Trigger Default Routing

LNP uses default routing defined by AIN 0.1 where the trigger default routing can be assigned to the LNP trigger. If the default routing feature is assigned, then when the SCP is unavailable, or the SCP response has a fatal error in it, the call will be routed as if an LNP response with Dialed Number message were received from the SCP and retranslate the Called Party DN using the LNP Routing Tables.

<REQ-IL-GR-180V1>
The LNP trigger can have the default routing capabilities assigned.

LNP trigger default routing will operate normally, and proceed as if the SCP responded with an LNP response with Dialed Number if the query fails and default routing is correctly assigned.

However, unlike the normal LNP response with Dialed Number response processing, the FCI will not be updated to indicate "Number Translated" and the "ported number" GAP will not be generated as a result of a failed LNP trigger and default routed call.

Independent of whether the switch already had a valid route prior to the query, digit analysis will be done on the Called Party DN, and the call will be routed based on the LNP Routing Tables.
<End of REQ-180>

4.1.1.2.6 Additional TAT-based LNP Trigger Forward_Call Response Processing

This section outlines additional requirements when the SCP provides the GAP information and FCI information in the LNP response. When a TAT-based LNP query is launched for LNP, the expected response is a Forward_Call message; however, the Send To Resource, Disconnect and Authorize Termination messages are acceptable within the protocol.

On receipt of a Termination Attempt query message engendered by a TAT-based LNP trigger, the LNP SCP is expected to return a Forward Call message to the querying SSP containing a *ForwardCallIndicator* parameter with the *Translated Called Number Indicator* field set to *Number Translated*. The format for the *ForwardCallIndicator* parameter is given in section 4.2 of this document.

If the LNP SCP determines that the dialed number has ported, it is expected to include a *GenericAddressList* parameter and a new *CalledPartyID* parameter in the Forward_Call message. The *GenericAddressList* parameter should contain the ported DN. The *CalledPartyID* parameter should contain the LRN. The format for the *GenericAddressList* parameter is given in section 4.2 of this document.

If the LNP SCP determines that the dialed number has not ported, it is expected to include a *CalledPartyID* parameter containing the non-ported DN.

The LNP SCP may choose to include a *RedirectingPartyID* in the Forward_Call message.

The SSP shall process the Forward_Call message based on the procedure set forth in AIN Release 0.1, with the following exceptions:

- the SSP shall accept a *RedirectingPartyID* in the Forward Call message responding to an LNP query. On receipt of a RedirectingPartyID parameter, the SSP shall increment the redirection counter, assign the RedirectingPartyID to either the Original Called or Redirecting Number (as appropriate), and set the corresponding Redirecting Reason to Unconditional. If the Forward Call message responding to an LNP query does not contain a RedirectingPartyID, the SSP shall not assign the terminating DN to either the Original Called or Redirecting Number, and shall not increment the Redirection Counter.

- the LNP SSP shall accept a GenericAddressList parameter in the Forward Call message, and shall map it into a GAP in the outgoing ISUP IAM message.

- the LNP SSP shall accept a ForwardCallIndicator parameter in the Forward Call message, and shall map it into the FCI parameter in the outgoing ISUP IAM message. The CalledPartyID in the Forward Call message shall be retranslated using the LNP Routing Tables when the ForwardCallIndicator parameter is included in the SCP response.

- if the CalledPartyID in the Forward Call message contains an LRN belonging to the switch, the SSP shall attempt to terminate the call to the DN identified in the GenericAddressList parameter.

The SSP does not expect to receive a Forward_Call message with carrier or trunk-group parameters from the LNP SCP; nevertheless, the SSP shall accept and process these parameters according to the procedures outlined in AIN Release 0.1.

<REQ-IL-GR-850V1>
The LNP SSP shall accept a ForwardCallIndicator parameter in a Forward Call message.
< End of REQ-850>

<REQ-IL-GR-860V1>
The SSP shall accept a RedirectingPartyID parameter in the Forward_Call message, and shall populate the appropriate redirection parameters on receipt of it. If the RedirectingPartyID parameter is not present in the Forward_Call message, the SSP shall not update the redirection parameters for the call.
< End of REQ-860>

<REQ-IL-GR-870V1>
The SSP shall accept a ported number GenericAddressList parameter in a Forward Call message.
< End of REQ-870>

<REQ-IL-GR-880V1>
If multiple ported number GenericAddress parameters are included in the GenericAddressList parameter, the SSP shall discard all but the last Ported Number GenericAddress parameter.
< End of REQ-880>